

IN THE CLAIMS:

The following listing of claims replaces all prior versions and listings of claims in this application.

1. (Currently Amended) A method for detecting characteristics of an object in a scene, the method comprising:

identifying projecting a projection array, comprising a plurality of projection elements arranged in rows and columns, used to project onto said scene and object coded light onto a scene containing the object, creating a pattern of said projection elements having a detectable characteristic that identifies a column in said projection array and belongs to a characteristic set of at least two characteristics, said pattern of projection elements being created from said projection array and defining a repeated pattern of staggered said columns; wherein the projection array comprises a plurality of projection elements;

obtaining capturing an image of the said scene with the said coded light projected onto said scene it;

identifying a plurality of image elements forming an image array from the a captured said image; and

determining for each image element in a captured said image, determining correspondence information that can be used useable to determine which projection element in the said plurality of projection elements corresponds to that image element, wherein determining correspondence information for each element is performed independently of knowing correspondence information for any other image element.

2. (Current Amended) The method of claim 1, further comprising: comprising determining position information for each identified image element based at least in part on the correspondence information for that said identified image element.

3. (Currently Amended) The method of claim 1, further comprising:

providing a projector to project said projection array;

providing a camera to capture said image array; and

determining position information for each identified image element based at least in part on ~~the~~ correspondence information for ~~that~~ said identified image element and on a position of a said projector relative to said camera ~~that supplies the projection array relative to a camera that obtains the image array.~~

4. (Currently Amended) The method of claim 1, wherein determining correspondence information ~~includes:~~ includes determining a row coordinate and a column coordinate in the said image array for at least one said image element ~~one or more image elements~~ based at least in part on a row coordinate and a column coordinate in the said projection array.

5. (Currently Amended) The method of claim 1, wherein determining correspondence information includes:

determining a row coordinate and a column coordinate in the said image array for at least one said image element; ~~one or more image elements~~; and  
for each at least one said image element, ~~of the one or more image elements~~,  
determining a row coordinate and a column coordinate for an element in the said projection array ~~that corresponds~~ corresponding to that said image element.

6. (Currently Amended) The method of claim 1, wherein ~~the step of~~ determining correspondence information is performed ~~without~~ absent prior determination of having to first determine correspondence information for an a calibration element in the said plurality of image elements ~~that is~~ designated as calibrating the correspondence information for all other image elements in the said plurality of image elements.

7. (Currently Amended) The method of claim 1, wherein ~~the step of~~ determining correspondence information is performed ~~without~~ absent prior determination of having to first determine correspondence information for an element in the said plurality of image elements ~~that is~~ designated as being a first element in a sequence of elements that correspond substantially to an entire row of elements in the said projection array.

8. (Currently Amended) The method of claim 1, wherein ~~the step of determining correspondence information includes identifying missing image elements by identifying at least one projection element lacking a one or more projection elements that have no corresponding image element in the~~ said image array.

9. (Currently Amended) The method of claim 8, further comprising ~~the step of compensating for the missing image elements by using image elements that are congruent to the~~ said missing image elements.

10. (Currently Amended) The method of claim 1, wherein projecting a projection array is carried out with a projector and identifying a projection array includes identifying data representing a tangible medium used to pattern light emitted from a said projector.

11. (Currently Amended) The method of claim 1, ~~wherein~~ further including: providing a projector to project said projection array; and identifying a projection array includes identifying data representing a diffraction pattern for structuring light emitted from a said projector.

12. (Currently Amended) The system of claim 26, wherein said means for projecting includes a projector, and identifies data representing a tangible medium used to pattern light emitted from said projector.

~~The method of claim 1, further comprising the step of projecting coded light onto the said scene to create a pattern of elements having a detectable characteristic belonging to a set of two or more characteristic, wherein the pattern of elements is created from the projection array.~~

13. (Currently Amended) The method of claim 12 1, wherein each of the characteristics in the characteristic in said characteristic set has a characteristic

selected from a group consisting of (a) is a geometric characteristic that is distinguishable from an other geometric characteristic in the said set, (b) a color from another color in the said set, and (c) a shape distinguishable from another shape in said set.

14. (Currently Amended) The system of claim 26, wherein said means for projecting includes a projector and includes data representing a diffraction pattern for structuring light emitted by said projector.

~~The method of claim 12, wherein each of the characteristics in the set is a color that is distinguishable from an other color in the set.~~

15. (Currently Amended) The system of claim 26, a characteristic in said characteristic set has a characteristic selected from a group consisting of (a) a geometric characteristic distinguishable from an other geometric characteristic in said set, (b) a color from another color in said set, and (c) a shape distinguishable from an other shape in said set.

~~The method of claim 12, wherein each of the characteristics in the set is a shape that is distinguishable from an other shape in the set.~~

16. (Currently Amended) The method of claim 42 1, further comprising:  
determining a sequence of values that can identify each of the projection element in said elements in the projection array;

assigning a sequence value ~~used in the sequence~~ to each characteristic in the said characteristic set of two or more characteristics; and

wherein ~~the step of projecting coded light includes projecting each projection element in the said projection array as one of the characteristics~~ a characteristic in the said characteristic set of two or more characteristics so that the said sequence can be at least partially reflected in the said pattern based on the sequence value assigned to each characteristic.

17. (Currently Amended) The method of claim 16, wherein assigning a sequence value ~~used in the sequence~~ includes assigning in a manner selected from a group consisting of (a) assigning a binary value, (b) assigning non-repeating binary values, (c) assigning using a non-N-repeating bit assignment formula, and (d) assigning a sequence subset to individual column coordinates so as to correspond elements in said projection array with elements in said image array.

18. (Currently Amended) The system of claim 26, further including:  
means for determining a sequence of values that can identify each projection element in said projection array;  
means for assigning a sequence value to each characteristic in said characteristic set;  
wherein said means for projecting projects coded light and projects each projection element in said projection array as a characteristic in said characteristic set so that said sequence can be at least partially reflected in the said pattern based on the sequence value assigned to each characteristic.

~~The method of claim 16, wherein determining a sequence of values includes determining the sequence comprising non-repeating binary values.~~

19. (Currently Amended) The system of claim 26, wherein a sequence value is assigned in a manner selected from a group consisting of (a) assigning a binary value, (b) assigning non-repeating binary values, (c) assigning using a non-N-repeating bit assignment formula, and (d) assigning a sequence subset to individual column coordinates so as to correspond elements in said projection array with elements in said image array.

~~The method of claim 18, wherein determining the sequence includes using a non-N-repeating bit assignment formula.~~

20. (Currently Amended) The system of claim 26, wherein said staggered arrangement is used in determining which projection elements in said projection array

lack a corresponding image element.

~~The method of claim 18, wherein determining the sequence includes assigning a subset of the sequence to individual column coordinates in order to correspond elements in the projection array with elements in the image array.~~

21. (Currently Amended) The method of claim 42 1, wherein projecting coded light ~~onto the scene to create a pattern of elements~~ includes creating the said pattern so that the detectable characteristics identify columns in the said projection array and so that each row in the said projection array has the a same set of columns.

22. (Currently Amended) The system of claim 26, wherein said means for projecting projects coded light and creates said pattern so that detectable characteristics identify columns in said projection array and so that each row in said projection array has a same set of columns.

~~The method of claim 12, wherein projecting coded light onto the scene to create a pattern of elements includes creating the pattern so that the detectable characteristics identify columns in the projection array and so that the columns are repeated in a staggered arrangement.~~

23. (Currently Amended) The method of claim 22 1, further comprising using said staggered arrangement to determine ~~determining~~ which projection elements in the said projection array ~~have no~~ lack a corresponding image element. ~~using the staggered arrangement.~~

24. (Currently Amended) The method of claim 24 1, further comprising identifying rows in said image array that lack a same column to determine ~~determining~~ which projection elements in the said projection array ~~have no~~ lack a corresponding image element. ~~by identifying which rows in the image array do not have the same columns.~~

25. (Currently Amended) The method of claim 1, wherein at least one method step is performed on at least one processor ~~one or more steps of the method are performed by one or more processors~~ executing instructions stored on a computer-readable medium.

26. (Currently Amended) A system to detect characteristics of an object in a scene, the system comprising:

means for projecting a projection array, comprising a plurality of projection elements arranged in rows and columns, to project onto said scene and object coded light creating a pattern of said projecting elements having a detectable characteristic that identifies a column in said position array and belongs to a characteristic set of at least two characteristics, said pattern of projection elements being created from said projection array and defining a repeated pattern of staggered said columns;

means for capturing an image of said scene with said coded light projected onto said scene;

means for identifying a plurality of image elements forming an image array from a captured said image; and

means for determining for each image element in a captured said image information useable to determine which projection element in said plurality of project elements corresponds to an image element, wherein determining correspondence information for each element is performed independently of knowing correspondence information for any other image element.

~~A method for creating a light pattern on a scene, the method comprising: creating a sequence of values comprising a plurality of subsequences, wherein each subsequence identifies one or more elements of a projection array independent of any other element in the projection array; assigning a value to a characteristic in a set of optically distinguishable characteristics; projecting light in a pattern in order to create at least a portion of the pattern on the scene, wherein the sequence is encoded into the pattern based on the value assigned to each characteristic in the set.~~

27. (Currently Amended) The system of claim 26, wherein said means for determining determines position information for each identified image element based at least in part on correspondence information for said identified image element.

~~The method of claim 26, wherein each of the characteristics in the set is a geometric characteristic that is distinguishable from an other geometric characteristic in the set.~~

28. (Currently Amended) The system of claim 26, wherein:  
said means for identifying a projection array includes a projector;  
said means for obtaining an image includes a camera; and  
said means for determining determines position information for each identified image element based at least in part on correspondence information for that said identified image element and on a position of a said projector relative to said camera.

~~The method of claim 26, wherein each of the characteristics in the set is a color that is distinguishable from an other color in the set.~~

29. (Currently Amended) The system of claim 26, wherein said means for determining determines a row coordinate and a column coordinate in said image array for at least one said image element based at least in part on a row coordinate and a column coordinate in the said projection array.

~~The method of claim 26, wherein each of the characteristics in the set is a shape that is distinguishable from an other shape in the set.~~

30. (Currently Amended) The system of claim 26, wherein said means for determining determines a row coordinate and a column coordinate in said image array for at least one said image element; and  
for each at least one said image element, determines a row coordinate and a column coordinate for an element in said projection array corresponding to said image element.

~~The method of claim 26, wherein assigning a value used in the sequence includes~~



~~assigning a binary value.~~

31. (Currently Amended) The system of claim 26, wherein said means for determining functions absent prior determination of correspondence information for a calibration element in said plurality of image elements designated as calibrating correspondence information for all other image elements in said plurality of image elements.

~~The method of claim 26, wherein creating a sequence of values includes determining a sequence comprising non-repeating subsets of binary values.~~

32. (Currently Amended) The system of claim 26, wherein said means for determining functions without prior determination of correspondence information for an element in said plurality of image elements designated as being a first element in a sequence of elements that correspond substantially to an entire row of elements in said projection array.

~~The method of claim 31, wherein determining the sequence includes using a non-N-repeating bit assignment formula.~~

33. (Currently Amended) The system of claim 26, wherein said means for determining identifies missing image elements by identifying at least one projection element lacking a corresponding image element in said image array.

~~The method of claim 26, wherein creating a sequence of values includes assigning a subset of the sequence to individual column coordinates in order to correspond elements in the projection array with elements in the image array.~~

34. (Currently Amended) The system of claim 33, wherein said means for determining compensates for missing image elements by using image elements congruent to said missing image elements.

~~The method of claim 26, wherein one or more steps of the method are performed by one or more processors executing instructions stored on a computer-readable~~

medium.

35. (Currently Amended) A system to detect characteristics of an object in a scene, the system comprising:

a projector to project a projection array, comprising a plurality of projection elements arranged in rows and columns, and to project onto said scene and object coded light creating a pattern of said projecting elements having a detectable characteristic that identifies a column in said position array and belongs to a characteristic set of at least two characteristics, said pattern of projection elements being created from said projection array and defining a repeated pattern of staggered said columns;

a camera to capture an image of said scene with said coded light projected onto said scene;

means for identifying a plurality of image elements forming an image array from a captured said image; and

means for determining for each image element in a captured said image information useable to determine which projection element in said plurality of project elements corresponds to an image element, wherein determining correspondence information for each element is performed independently of knowing correspondence information for any other image element.

~~A system for detecting characteristics of an object, the system comprising: a projector configured to project coded light that is created from a projection array onto a scene containing the object, wherein the projection array comprises a plurality of projection elements; a camera system to capture an image of the scene with the coded light; and a processor coupled to the processor and configured to: determine correspondence information that can be used to determine which projection element in the plurality of projection elements corresponds to a particular image element.~~

36. (Currently Amended) The system of claim 26, further including identifying rows in said image array that lack a same column to determine which projection

elements in said projection array lack a corresponding image element.

~~The system of claim 35, wherein the processor is configured to determine the correspondence information independently of determining correspondence information for other elements in the image array.~~

37. (Currently Amended) The system of claim 26, further including identifying rows in said image array that lack a same column to determine which projection elements in said projection array lack a corresponding image element.

~~The system of claim 35, wherein the processor is configured to determine the correspondence information independently of determining correspondence information for all other elements in the image array except for a set of congruent image elements that include the particular image element.~~